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ABSTRACT

Groups and educators have sought to construct gender-sensitive learning environments for women and girls in science, thus providing them with opportunities to legitimately participate in the science and science education communities. Results of the study reported in this paper show that women science educators who work to provide such contexts experience multiple obstacles, conflicts, tensions, and dilemmas that are situated in issues of power and politics which interrupt their efforts to facilitate girls' and women's opportunities to engage in science. Groups studied included an after-school science club for girls under the direction of a woman science educator, and a group of university women working in science at an academic research institution. Data were collected in the form of interviews, field notes taken during participant observation, and analysis of group materials and other documents. Suggestions for solving some of the dilemmas are provided that include providing women and girls with contexts to meet together, speak, and make decisions within multiple contexts such as local science programs, the everyday school and work environment, and national decision-making structures. Contains 28 references. (PVD)

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# Meeting Women's and Girls' Special Needs: "Gender-Sensitive" Environments and the Roadblocks Women Science Educators Face

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by

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## INTRODUCTION

Substantial research documents the under-representation of women and girls in science-related careers and science coursework (AAUW, 1992; National Science Foundation, 1992; Oakes, 1990; Vetter, 1992). In addition, even today amidst the implementation of progressive science education reform, educational institutions, organizations, and policy-makers continue to establish policies that are "gender-blind" in that they ignore the issues and experiences unique to women and girls and fail to address important aspects of women's and girls' education that are critical to their futures (AAUW, 1992; Harding, 1991; Martin, 1992). Furthermore, numerous researchers (Delamont, 1989; Harding, 1991; Martin, 1989; Oakes, 1990; Sadker, Sadker, and Klein, 1990; Schiebinger, 1990; Seymour, 1995) have described how, historically, inequitable social structures and unfair practices within the science community have served to limit and/or exclude women's and girls' participation in it.

Groups and educators have sought to construct "gender-sensitive" learning environments for women and girls in science and thus provide them with opportunities to legitimately participate in the science and science education communities (AAUW, 1992; Keith & Keith, 1989; Kreinberg & Lewis, 1996). However, as this paper will show, women science educators who work to provide such contexts experience multiple obstacles, conflicts, tensions, and dilemmas that are situated in issues of power and politics and that interrupt their efforts to facilitate girls' and women's opportunities to engage in science.

## THEORETICAL FRAMEWORK

As women science educators construct gender-sensitive environments for women and girls and consider the factors that are key to their legitimate participation in science, similarly, it is important to consider how these same factors are integral to their own participation--their position, power, and practice--in the science community and in their everyday educational and work environments. To be "gender-sensitive" means to deal with issues that pertain to women and girls when they make a difference in their educations and careers (Martin, 1992). Gender-sensitive practices include: removing gender bias and other barriers to women's and girls' pursuit of science; acknowledging the social dynamics of the classroom setting; recognizing the impact of women's and girls' personal and private experiences on their education; and making transparent the necessary knowledge, skills, resources, ways, and practices valued in the science community (Davis, 1996a, 1996b). Furthermore, several issues must be considered when reflecting on the legitimate participation of individuals within a community such as science, namely 1) the acquisition of the necessary knowledge, skills, and other resources valued in the community, 2) access to the community to acquire these competencies, and 3) open, equitable, and engaged participation in the group (Lave & Wenger, 1991).

Bourdieu (Bourdieu & Wacquant, 1992) and Delamont (1989) contend that in order to participate legitimately within a given group, such as science, an individual must acquire the capital[1]--knowledge, skills, economic

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[1]Capital is what an individual has and uses that enables one to legitimately take part in the practices of a group. Capital takes several forms: Cultural capital (i.e., knowledge, skills, tacit competencies), economic capital (i.e., money, grants, scholarships), symbolic capital (i.e., prestige, awards, credibility in the community), and social capital (i.e., mentors and valuable networks) (Jenkins, 1992).

resources, status, credibility, and social networks--valued by that community. Bourdieu argues that one's relative force and/or position within a community depends on the quantity and quality of one's capital. He states:

> capital is what is efficacious in a given field, both as a weapon and as a stake of struggle, that which allows its possessors to wield a power, an influence, and thus to exist, in the field under consideration, instead of being considered a negligible quantity. (Bourdieu & Wacquant, 1992, p. 98)

Individuals acquire the knowledge, skills, and other forms of capital valued in a community through immersion in its environment and legitimate participation in its practices (Lave & Wenger, 1991). It is through social interaction with old-timers and novices in the community that newcomers come to learn and make transparent the valued structures, knowledge, ways, practices, talk, and artifacts of the group.

However, legitimate participation is much more than the process of newcomers' learning. Embedded within the concept of legitimate participation is the idea that individuals interact and contribute as valued participants in the change and construction of new and evolving capital, values, and practices of the group (Lave & Wenger, 1991). Through legitimate participation, individuals and groups in the community

> act out their differences and discover their commonalties...and come to terms with their need for one another....Conflict is experienced and worked out through a shared everyday practice in which differing viewpoints and common stakes are in interplay. (p. 116)

Therefore, legitimate participation involves the interrelationships and interactions between diverse individuals and groups and their practices in the community and results in community development and change.

However, Lave and Wenger contend that inequitable structures and power relations within a community can open, limit, or close legitimate participation to individuals or groups within it. Such activity can limit an individual's or group's sharing of common and differing viewpoints and new thinking and inhibit their participation in the evolution of the community as well as impede their acquisition of needed capital and affect their legitimacy in the community.

Within communities there may be door-openers and gatekeepers to legitimate participation (Davis, 1991). Individuals in positions of power within institutions can act as institutional agents and provide others with the necessary capital, resources, and support that they need to progress through institutional systems (Stanton-Salazar, Vasquez, & Mehan, 1995). For example, in previous work, I found numerous examples of science teachers, primarily men, who were powerful in that they enabled women to move forward in their careers (Davis, 1991). Similarly, these teachers also had the power to impede women's progress. Thus, individuals with status and power in a community can provide, confer, or deny access, capital, resources, support, and, thus, legitimacy to others. Lave and Wenger point out that if access and/or participation is blocked, intentionally or otherwise, then individuals can be disempowered or marginalized within the community.

Importantly, a community may value social equality and respect, invite, and include the values, needs, and interests of many individuals and groups. Here, everyone would engage in public discussion and decision-making regarding the community's structures and practices and individual members' roles and experiences in it (Young, 1990).

Several mechanisms are needed for the successful representation and acknowledgment of diverse voices and perspectives within a community.

The first of these mechanisms is the self-organization of group members or the formation of collective groups (Young, 1990). Young emphasizes that those oppressed within communities (such as women in the science community) need to talk among themselves, come to understand their daily interests, needs, and experiences and then to generate policy that will support them in their endeavors. Within their communities, decision-makers must then show that they have taken into consideration the proposals of these groups, and such groups must have veto power regarding specific policies that affect them.

In sum, legitimate participation encompasses many key factors including the acquisition of valued capital, access to the community of practice, and voice and decision-making power within that community. In this study, it became evident that as female scientists and science educators sought to construct gender-sensitive learning environments to support women's and girls' legitimate participation in science, they encountered many obstacles to their own legitimate participation in their everyday educational and work settings. As these woman science educators sought to open doors for others to legitimate participation in the science community and faced their own struggles, there were many questions to examine.

•What knowledge do they have of the barriers women face in the science profession?

•What conflicts, barriers, tensions, or dilemmas do they face in their attempts to facilitate women and girls legitimate participation in science and their own participation? How do they perceive women overcoming and/or removing those barriers? What actions do they take?

•How do they perceive the structures and the practices of the science community? In particular, do they have contexts to voice their values, needs,

and experiences? Do they have power to make decisions at various levels within the science community and their own daily settings?

## STUDY SITES AND METHODOLOGY

The sites for this study included Explorers[2], an after-school science club, where girls engaged in hands-on science activities under the guidance of a woman science educator. The club was one of several programs offered the Foothills City Youth Club (FCYC)--a racially and ethnically diverse co-ed city youth club located in an urban community situated near the Rocky Mountains.

The second group was Women in Science (WIS)--a group of university women working in science at an academic research institution. WIS included professors, graduate students, researchers, post-docs, and science educators, and was facilitated by a tenured professor. The group met to discuss issues important to them and other women in the science profession.

Data for this study was collected in the form of interviews, field notes taken during participant observation, and analysis of group materials and other documents. The analysis includes particular description in form of vignettes and direct quotes, general description in the form of taxonomies and diagrams, and interpretive commentary to provide explanation and connection within the analysis (Erickson, 1986).

## RESULTS

As the women science educators in this study sought to construct gender-sensitive learning environments, they experienced numerous

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[2]Pseudonyms for the names of individuals, groups, organizations, and institutions are used throughout to protect the confidentiality of informants.

obstacles, dilemmas, tensions, and constraints that impeded their efforts. The results of this study show that in both the Explorers and WIS settings, the women science educators who facilitated these groups were often not provided equitable contexts to voice their values, needs, and experiences and make decisions in their communities that would impact their work with women and girls, their educations, and their careers. In many ways, they were often marginalized within their communities, much like the women and girls they were aiming to support. However, the women in these groups, through their interactions with each other, constructed ways to assess their experiences and needs and to voice them within their daily environments and thus create change for themselves and other females.

I will describe how the participants in this study addressed these conflicts first in the context of Explorers and then the Women in Science group. I will conclude this paper with recommendations for gender-sensitive approaches that support women's and girls' legitimate participation in science.

Meeting the Special Needs of Girls

The girls served by the Explorers program and the Foothills City Youth Club were primarily from disadvantaged circumstances. More than 50% lived in single-parent homes where working females were the head of the household. Seventy-seven percent lived at or below the level of poverty. Fifty percent of the children's families received some kind of public assistance.

In addition, issues including unemployment, teenage pregnancy, drug and alcohol abuse affected Foothills City youth. Minority youth unemployment ranged from 25-28%. In the previous decade, female

unemployment had increased 12%. The school dropout rate in Foothills City was 4%, and though Latinos comprised 28.8% of the school population, 63% of those leaving school before graduation were Latino. Between 1986 and 1991, adolescent pregnancy had increased from 16.3% to 20.2%. The teenage birth rate for Latinas was 38% and for African-American girls was 43%. Though 39% of the Foothills City population, Latinos comprised 88% of teen DUI arrests in 1991.

In light of these community issues, the Foothills City Youth Club sought to

> effectively meet the needs of youth in Foothills County, to help them overcome the effects of disadvantaged circumstances and to develop their capacity to be self-sufficient, responsible members of the community; and to serve as a vigorous advocate for youth focusing attention on the special needs of girls and the special needs of boys.

In particular, the organization aimed to enable girls "to conquer life's basic challenges in areas both traditional and non-traditional for women,...to prepare them to function independently and interdependently" and "to pursue careers that will provide them with economic autonomy." A major purpose of the Explorer's program was "to convince girls that they have options other than low paying jobs in the pink-collar ghetto--and that sticking with math and science will help keep those options open." Therefore, the goals of the Explorers program were to stimulate girls' interest in science, math, and technology, to encourage girls in science by providing them with fun, motivating, and positive experiences, and to motivate girls to stay with math and science courses in school so that they might consider and pursue careers that have been traditionally closed to them. Explorers' documents repeatedly pointed out the need for girls' continued education, especially in

the areas of math and science, in order for them to be able to choose and engage in better paying careers.

In the context of Explorers, girls developed science process skills--they asked questions, gathered information, and used a variety of everyday tools such as measuring spoons and cups, rulers, scissors, and screwdrivers to do such things as measure, mix, count, sort, describe, take apart, reassemble, and construct. Explorers activities were followed with opportunities for girls to reflect, discuss, and process what they had done and learned. (See Table 1.) [3]

Explorers leaders provided girls with all of the necessary materials, the curriculum, the meeting space, guidance, and the program structure needed to engage in hands-on science activities, and they encouraged girls to explore, discover, be creative, and take risks. However, though the program leaders provided girls with opportunities to engage in math and science activities, there were many obstacles that weakened the efforts of Explorers leaders to meet the goals of the program and, thus, to meet the special needs of girls. To understand these obstacles, it is necessary to have a historical perspective of the FCYC.

Once upon a time--a few years previous to this study--the Explorers leaders in this study worked with "just-girls" in a community organization called the Girls Youth Club (GYC). There, leaders focused on the importance of providing girls knowledge and skills through research-based programs and organized activities so that girls would be able to improve their lives--economically and in other ways as well. The GYC was a strong and viable organization that met the needs of many girls in the community.

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[3]For more description of the activities of this group, see Davis, K. S. (1996). Science support groups for women and girls: Capturing the capital, challenging the boundaries, and defining the limits of the science community. Unpublished Doctoral Dissertation. Boulder, CO: University of Colorado.

Then came "the merger." In 1991, city and county government and private funding agencies "forced" a merger between the Boys Youth Club (BYC) and the Girls Youth Club (GYC) in Foothills City. The organizations needed to combine their programs in order to continue to receive community financial support as the principle community funding agencies felt hard-pressed to continue to support two separate organizations that they perceived to have similar goals.

However, in contrast to the perceptions of community leaders, the two organizations were, in reality, quite different. The Boys Youth Club was struggling under weak leadership and poor economic times to provide boys with regular recreational activities. It did not offer educational or career-focused programs. In retrospect, though both organizations were seeking to aid children in the community, the BYC and the GYC of Foothills City operated with varying degrees of vigor and vitality and under different philosophies as to how to address the needs of children.

The female leadership of the GYC had little voice in the decision, yet the merger affected the work of the women leaders in many ways. It created a great economic strain that weakened programs for girls as well as for boys. In addition, the merger complicated and diluted leaders' efforts to address the needs of girls as the new organization's mission included meeting the needs of boys as well. Thirdly, it brought to the forefront the conflicts, tensions, and dilemmas Explorers leaders had with traditional, societal beliefs and practices as they interacted daily with boys and girls in a coeducational environment. Furthermore, it highlighted how few contexts and/or opportunities women science educators were given by the community to reflect on their experiences, voice concerns, and/or make decisions that would support their needs and goals. What was critical to the survival of their program was the

ability of women to speak out about their mission and values regarding meeting the needs of children, girls in particular, and the subsequent needs and concerns of the organization.

Speaking Out for Economic Resources

Though the merger was grounded in financial issues, it did not provide a true context for saving money. The city believed that the FCYC should be able to get by with less staff, since they were bringing together two organizations. In reality, the Boy's Youth Club was understaffed, and so new staff needed to be hired and new programs needed to be developed to meet the needs of the new and increased population of the club. Yet the city cut support after the merger by almost 6%. (See Table 2.) In the ensuing years, though the total number of children served by the FCYC nearly doubled, city and county allocations remained constant decreasing the support per child by 50%.

Following the merger, the organization struggled. Lack of adequate funding made it difficult for the organization to adequately staff and provide regularly scheduled programs like Explorers, work with the children in depth, provide staff with the time necessary for planning and reflection with club members and other staff, and achieve its goals. For example, when one Explorers leader left the FCYC towards the end of this study for another position, the FCYC did not replace her, and her Explorers group only met once after that. One Explorers leader summarized the impact of the financial strain on the Explorers program:

> [I]t's not a full commitment on the FCYC's part and maybe that's just the way it has to be at least right now. I think intellectually we're definitely committed to [Explorers] but, and maybe it's just because our organization has been in such turbulent times and

> just trying to survive, and so you do what you need to do to survive. So in that sense it's difficult to prioritize and really make that solid commitment...

Yearly, FCYC leaders and representatives presented to community leaders the scope of the organization's programming to meet the needs of local youth, the positive community impact, and the continued need for increased funding. However, after inadequate community allocations were announced in both 1993 and 1994, the FCYC Executive Director "pounded on the door" of city funding agents to obtain additional support. The women leaders of the organization spoke with funding agents regarding the limited moneys available to meet the goals of the organization and the need for additional support. As a result of their persistence and speaking out, they acquired more funds through Community Development Block Grants (CDBG's).[4] However, the city government referred to such actions as "double-dipping" and discouraged the organization's leadership from making such requests in the future.

Speaking Out About Differences

The merger also raised some conflicts within the organization regarding what philosophical beliefs should frame the policies, programs, and practices of the new organization. The FCYC leadership sought to maintain the long held goals of the GYC--to meet the needs of girls. However, since the merger, the FCYC tried "to make things equal" (between boys and girls). A leader explained:

> When we first merged...the thought was everything has to be the same. We['ve] got to make everything the same. We were so worried that anyone was going to say..."Oh they're (boys/girls

[4]CDBG's are federal moneys that are set aside for programs that will benefit individuals from low to moderate incomes.

> are) getting more" or "They're (girls/boys are) getting less" it was like...you [have to make] everything the same. Well how ridiculous, but we had to do it, and, I mean, even in retrospect... it was probably good to do that. I mean that was just called survival and trying to keep the organization together....It was a year before I could say, "But it is different."....I felt bad when I said it to the first staff person...."There [are] differences, there [are] differences from these kids that," and someone will to come in and [say], "The kids are kids," and kids are still kids, but you [have] got [to] recognize that things in their environments are going to make them...things different.

This staff member was not sure that the organization could make the commitment to meet the needs of girls considering that boys were included in the organization. "I don't even know if we could within our mission, I mean, do the real kind of commitment that you have [to] when you have to consider the boys aspect." The FCYC strove to meet the needs of girls through special programs, yet some leaders within the organization also believed that boys should be provided with the same (equal) programs. That was why the Explorers program, though written specifically for girls, was offered to both boys and girls at FCYC, but in single-sex settings.

Due to such conflicts around beliefs and programming and because of funding, time, and staff constraints, girls may not have received the programs that they needed. For example, one Explorers leader acknowledged that more could have been done for girls in the way of activities and programs, such as "during Women's History week," if the organization's concentration had been more on the needs of girls.

Importantly, the voices of female leaders have held off outside efforts to dissolve support for girls-only programs. Specifically, the national City Youth Clubs of America, with whom the new FCYC affiliated after the merger, questioned why the FCYC needed to also maintain their affiliation with the national Girls Youth Clubs. The Director of the FCYC argued that

the national organization of Girls Youth Clubs was a valuable resource for research-based programs that were gender specific--written specifically to address the needs and issues of girls into today's society. The national office also provided leadership and training for staff in these programs. In contrast, the City Youth Clubs of America focused solely on coeducational programs. The FCYC mission statement described one of the organization's goals as "to serve as a vigorous advocate for youth focusing attention on the special needs of girls and the special needs of boys." The Director argued that the FCYC mission statement now included the goals of both organizations, it did not combine them, and the FCYC needed to acknowledge the distinctive needs and issues of boys and of girls in today's society and provide programming to address both populations. Therefore, throughout the early years of this organization, the voice of the female leadership was imperative in the preservation of programs for girls.

The Need for Reflection with Others

The merger and the coeducational environment that it created, also brought to the forefront traditional, societal expectations for women and girls and created daily conflicts and dilemmas for them as they interacted daily with boys and men in the coed context. For example, within the larger context of the FCYC, boys often dominated adult talk and attention. It was rarely possible to have a conversation with a girl without boys interrupting. The following field notes provide an example.

• • •

I wanted to talk to a couple of girls who were sitting at the computer center and find out what they were doing. However, a nine-year old boy started talking with me about the computers and about how his father was a pilot and how he hopes to go into the space program. He talked about how he

was going on an airplane trip with his father. He really tried to engage me in conversation. He continued to talk about his step-father who has a degree in chemistry and who was hoping to find a job in his field.

I was very conscious of the fact that he was taking my time. I wanted to give him time, but realized that he would take all of my time. There was no way that I was going to be able to ask these girls what they were doing or have any conversation with them, more or less provide them with equitable time. Finally, I told him that I was going to hunt up the Explorers class and he said, "Well, I'll talk to you while I walk you there."

• • •

I shared the incident with a staff member. In order to talk to girls "you basically have to shut boys off," I told her. "And we're told you don't do that," she quickly replied. "I mean you wouldn't do that [to] anybody but maybe there's even a stronger [message] that you wouldn't do it to a boy, because they're less accepting of it. [With] a girl you could probably get away with...[that] a lot easier."

Kemper (cited in Bartky, 1990) describes this voluntary compliance with the needs, wishes, or interests of another" as "status accord" (p. 109). For example, through frequent smiling and other bodily gestures, a woman urges a "man to continue his recital, hence, that he may continue to commandeer the woman's time and attention" (Bartky, 1990, p. 109). When such "status" is not returned, the consistent attention by a woman is "acknowledgment of male supremacy" and women's "inferior position in the hierarchy of gender" (p. 109). The contradiction--the societal message that women--myself included--should continue to listen past the point of interest, desire, or need and the inability to model a different dynamic for girls or boys is embedded within the staff member and myself. However the message of the mission statement--to meet the needs of girls and boys--would indicate that the

dynamics of communication between boys and women and girl need to be changed.

Though knowledgeable about the ways in which women's and girls' oppression is embedded in society and demonstrated continuously in daily contexts, one staff member found that due to time and daily pressures, and I believe, conflicting societal messages, that she was rarely able to provide an environment that served to make changes in the dynamic of interaction between girls and boys at the center. For example, Carmen, an Explorers leader, described how she often "rescues" a girl.

> ...I rescue a girl, you know, because a boy's bugging her and...she tells me, "Oh he keeps bugging me and he won't leave me alone." Sometimes I'll say [to him], "Well just leave her alone and stop pestering her, she already asked [you] now leave her alone" instead of saying [to her], "OK, so what do we want to do about it?" Sometimes it's maybe I think I can do that, but I don't have time, 'cause it's going to take...more time for me to take her hand and to say, "OK you need to tell him...What do you think you should...?" And "I'll stand here by you and you tell him to leave you alone because I'm not going to be here next time maybe, so you need to be able to defend yourself. You go over there and I'll support you and I'll stand there and you tell him and I bet if I'm there and you give him the look that you really mean business and you're not playing around, he won't do it anymore." [S]ometimes I don't have time for that, because I don't think about it, I just react "Leave her alone, she said to leave her alone and stop it", you know...instead of having her do it. So I think in those rescuing situations I'm probably saying things that I'm not even conscious of at all, that I do for girls and for not having the expectations that they can do something.

So, though the leaders of Explorers sought to empower girls, a girl is "rescued"--but only so that she can be "pestered" again, and a boy is not engaged in a different dynamic where his behavior is confronted in a way other than punishment and scolding.

What needs to be considered in order to change the beliefs and practices of both women in girls in such settings? Explorers leaders contended that

girls need opportunities to talk among themselves and build a sense of sisterhood in order to better understand themselves and make decisions amidst stereotypical societal expectations in their daily environments. One leader stated:

> I think what's of value to the girls...at least the minim[um] I can do is give them time...to be with just girls, that...space to be curious and to be encouraged....[W]hen there are just girls there...they can learn the positiveness and the power that can come from that....There's not too many of those [places, as] schools [are] co-ed settings,...[and then]... after school, they are in their homes more than likely. It's all male-female so that now they have no opportunity to feel and accept the power that I think could come on up, more of a sense of sisterhood.

Another Explorers leader described this vision of sisterhood as

> supporting each other as women...identifying with one another...realizing we are all dealing with the same pressures and different influences: What our parents want us to be. What our significant others want us to be. Whatever society says we should be. [That we] don't fight with each other...[or] put each other down because of how we look, or [don't say], "I can't be your friend." That it's more "You're OK." [It's] a unity or [that] we can help each other...

Thus, sisterhood avails women and girls with personal acknowledgment and support for who they are as individuals as well as to pursue the personal and career goals that they value.

The interactions of the FCYC leadership were similar to the sisterhood they envision for girls. For example, when Carmen came to the Girls Youth Club as Program Director, Janice, the Executive Director, encouraged her to return to college and get her degree. In their work setting, Explorers leaders served as "sounding boards" for each other--"someone to share the work with as well as the frustrations and the good times...the exciting parts" of their jobs.

Furthermore, as leaders in the Girls Youth Club, these women read and discussed program-related literature with each other. Through their

interactions, the Explorers leadership came to understand women's issues and what women and girls face in their daily lives. They were then able to relate these issues to anything about the workings of the GYC and, later, the FCYC.

In addition, one Explorers leader came to recognize and acknowledge her own abilities and talents that had gone unnoticed and uncelebrated during her early childhood and adolescence. As these were things that Carmen did not learn when she was a young girl, she termed this experience as "growing up in the Girls Youth Club."

> [W]hen I talk about the [Girls Youth Club]...I feel like I grew up there and I really didn't know anything about women's issues or just my own experience, and...I used to think, "I've changed so much" but..., when I talk to people, I guess I was always as verbal...and I had leadership skills, but I never knew that I did, and I really thought that I had developed them at the [GYC] ....[T]hen I look back, well shoot, I was president of FBLA, and I was real active in [a church] group and I was one of the ones that was selected to the board to represent the youth....I now recognize that I had these [skills]. I thought I really didn't develop [them] until maybe the last few years because I kind of changed so much....We can change and we can work on things and that's great and I think I've tried to do that too, but...it was affirming to know Geez!...I just [hadn't] recognized that they were there....I wasn't having anybody tell me (as a child), "You have leadership potential"....No one said that for me and I never made that connection on my own, I just assumed it wasn't there, but I think it was. So I was never a member of the [GYC], but in a way I was, since I was working there I was a member because actually I learned a lot.

Through her experiences in the Girls Youth Club and her interactions and reflections with others, Carmen came to understand more about the issues important to women's and girls' education and careers as well as her own strengths and qualities.

Explorer leaders frequently mentioned the need for continued reflection with other staff about the obstacles, tensions, and dilemmas that

they face in their daily environment, such as the social dynamics of the coeducational setting. However, the lack of money, support and thus, time inhibited women in the FCYC from meeting on a regular basis. The Women in Science group further exemplifies of how such a context is valuable for women's participation in a community.

Meeting the Needs of Women: A Context for Voice and Decision-Making

The Women in Science (WIS) came to their group with a great wealth of scientific, mathematical, and technological knowledge, especially that which was relevant to their particular science fields. All of the WIS members had graduate degrees in their science fields and had participated in scientific research. As they walked over to the WIS meeting place from their labs and as they settled down at the table with their cups of tea or coffee, they easily conversed about their research, their progress and problems, and the methods and tools of their fields of study. As they came to the regular weekly meetings, it was not the content knowledge of their discipline or any other that they sought.

Their questions during the meeting were about the culture of the science community. Much of what the women in this group wanted to know can be described as the indeterminate knowledge of the science community (Delamont, 1989)--those hidden aspects and ways of the science community, the implicit competencies of being a scientist, and the undescribed ways of being a member of the science community.

The group was also a place to acquire a "sense of belonging" where members could talk about who they were and develop a community. Some members had experienced exclusion by male colleagues from informal gatherings in their daily environments (i.e., "beer drinking...fish catching"

events) or had felt "very uncomfortable with the...more combative, one-up male sort of discussions" of departmental clubs, seminars, or meetings.

Initially, the group was organized by graduate students who sought various kinds of support from the female faculty. The graduate students sought departmental approval for the group's meetings, and it was the faculty women who signed meeting notices and who reserved conference rooms in the department. Graduate students viewed WIS as an opportunity to get to know female faculty members, to hear about and learn from their experience within the science community, and to learn "what you're supposed to do to play the game" (i.e. "How do you go about being a good graduate student?"). So during the first year, the group's discussions "centered on topics that would help graduate students" and that provided them with a kind of mentoring.

Over time, the faculty women and post-docs came to want something from the group as well, and, as a result, the WIS group addressed the issues, concerns, and problems brought up by any member. The group met to understand situations and problems in their daily educational and work environments and to construct new practices and solutions. One member described the group as

> focused less on describing problems that exist[ed] and more interested in trying to find solutions or take action to change things...there's a place to discuss things or hear other people's ideas...

WIS members believed that the group helped them to develop a better understanding of career options, departmental and collegial interactions, and ways to deal with situations that might otherwise have been very uncomfortable or difficult. The WIS group discussed such topics as: communication in the science community, alternative careers to academia,

women's health, what happens during a job interview, crying, gender neutral language, self-defense, the silencing of women, and the balancing of family and career. The interactions of members in the WIS group provided its members with support, effective help and assistance, and friendship with other women in the profession. Within the group, members supported each other in ways such as: encouraging members to speak up in departmental meetings, suggesting valuable connections to whom to apply for grant money, presenting a range of ways to solve work-related problems, modeling various career choices, reviewing grant proposals, team-teaching classes, reading drafts of papers and giving critical feedback, and writing letters of recommendation.

Conflicts Around Women's Meeting Together and Speaking Out

During the group's first years, the women met regularly in a conference room in the department. They invited many speakers, a format which followed in the tradition of afternoon science seminars of their department and which made their meeting together more acceptable within the department. One WIS member points out, "It was not OK if [we] were just sitting around talking with each other, although men do it all the time."

However, there was suspicion, criticism, and opposition within the department, towards the group. One male professor would position himself outside the meeting room to observe who attended. One member's advisor vehemently opposed her participation.

> My advisor...was really against the women meeting...He outright told us that we shouldn't be meeting, that women meeting separately was divisive of the department, and, if we wanted to meet, we should have it open to everybody and not just women....And so we started doing things like leaving the doors open...so that if people wanted to stand outside [in] the hall and

> listen, they could hear what we were talking about and that we weren't talking about men....I guess he really believed [that] we were slandering him behind his back or this, that, and the other....To this day, I don't know what he thought, but he was really opposed to our meeting. And he would do things...like start an argument with me right before the women's group, and then, of course, [I would have to say], "I can't finish this, I have to go because I have a meeting." I wouldn't say that I was going to the women's group...[but] that would infuriate him even more, that I would stop an argument with him which I thought was a means [of keeping me] from getting to the meeting on time.

One WIS member shared that, "One of the things that I remember from the discussions in earlier groups is that there would be...women with a range of ideas about what was going on, so some women would say there's no problem." For example, at one meeting during the first year, the group had asked women who had children to come and share their experiences about being women in science and also mothers. One woman faculty member who had not attended the group previously but who had recently had a child said, "There's no problem with anything. You know, I don't know what you people are doing here." Another WIS participant explained that she had

> run into quite a number of women who will deny that there is any problem and who would certainly never complain about anything...they just grin and bear it, go on and do the very best, and if you're a good scientist, no one is going to argue with you, and you're going to make it in the system the way it exists. You have to make it in that system, you have to buy into that system and do everything according to the list that preexists...instead of thinking that it doesn't really have to be done this way. [M]aybe there is a better way to do it. I think a lot of people don't ever reflect that there are other ways of doing it.

Some women who attended the WIS group in the early years described the group as "just women complaining," "negative," and "too radical." However, a current member saw "complaining" as a "growth process. Sometimes when you're having a problem, the first way it comes out is as a

complaint, and then you as a group come up with an answer." Some new women graduate students in the early group could not identify with the "complaints" expressed by other women. Yet, later, they came to say, "I didn't believe you in the women's group in those first years...but I've had this experience I want to tell you about..." and then they would tell a group member "these phenomenal horror stories of things that happened to them."

As women spoke about what before had been private, their personal experiences also became political. Another member stated

> ...There are a couple women...that are less willing to explore the women's experience....[T]hey really want to say, 'Yea, well men really have helped me out here' and I want to say, 'Yea, men really have helped us out, but that's not what we're talking about in this group'....I think they are satisfied with men who have really helped them out, and those sorts of statements say to me in sort of unspoken language that they are not comfortable going the next step....[T]hey're not really willing to go look at the other side of the coin. Where have they not helped us out? That's what our group is about; [it's] not about where we did get help.

Lastly, some women who resisted joining the group in the early years said things like, "Well, we don't want to be thought of as a bunch of lesbians." Rich (in Trask, 1986) states that female oppression is based on a "sexual understructure," and Trask (1986) describes at length how women's oppression hinges on heterosexuality. Women meeting without men and in spite of male opposition indicates that women can think, speak, and act for themselves which threatens the oppressive dogma and societal stereotype that states otherwise--a woman is nothing without a man. Therefore the patriarchal dynamic is threatened. Women meeting together challenges men's power over women which in turn threatens "male identity and self-definition" (MacKinnon, 1989, p. 92). A threat to men's power and women's oppression is a threat to the heterosexual understructure. Women who

normally define themselves with respect to men may feel their sexual identity threatened as well (Trask, 1986).

During this study, the women in the group acknowledged that there are problems for women in the science community and they were interested in discussing such issues. The group felt that it was important that women have a safe context--"an outside room"--where they could speak freely. The WIS group moved its meeting away from the science department to a place where they could more easily share situations and problems and process solutions.

Critical to WIS members participation in science were the opportunities that participants had in the group: to interact with each other; share experiences and ideas; construct understandings about their daily environments, the science community, and society; solve problems; and construct new practices. The following vignette illuminates how, through their interactions within the group to engage in a community event and construct and present a slide show, WIS members further facilitated their participation in the science community. They used this project to 1) express what they and other women valued, their experiences within the science community, and the changes necessary for their participation and 2) enact change within their daily context to address their needs and experiences.

## The Slide Show

Seven women move enthusiastically around the tables, working to arrange sheets of paper filled with information onto colorful frames of posterboard. They are constructing a presentation and slide show that tells about the WIS group--its members, its history, its purpose, its discourse, and the sources of support that the women have constructed for themselves and the external sources that they have mined.

The presentation and its construction is political from multiple viewpoints. The call came from the department for graduate students to prepare presentations describing their research as part of an open house for

new graduate students. It was a competition; there would be a monetary prize to the best presentation.

The slide show is a declarative statement of women. It speaks out against the competition and the traditional discourse of science. It explodes with, "Here we are, we are alive, we are not going away. Here we are and here's what we do. You, other women, you too can get this sort of help and assistance."

The group had surveyed women in the sciences from across the university campus. Through the words of these women, they reveal the secrets of the oppression. Numerous frames are devoted to such themes as the challenges women experience in pursuing a career in science--

> Being a woman. Having a *horrible* graduate thesis advisor. These challenges are so overwhelming. The only way to survive is to plug along and not give up. I recommend finding support of other women --it's amazing how many women scientists will take time to speak to students. Don't be shy! Seek them out.
>
> The greatest challenge has been to maintain any self-esteem through the gauntlet of graduate school. It seems to be designed to destroy you physically and mentally.

and the ways women would change science and the profession--

> I would make science a more cooperative, supportive effort. So often I feel that it's this competitive endeavor in the white-male model of "I'm up and you're down..."

Women's words describing their experiences, thoughts, and feelings fill each frame.

The women converse with each other as they type, glue, and make changes at the computer. As the women work, they reflect about their interactions with each other compared to the interactions they experience with others in the workplace.

"Why can't my science be like putting this presentation together?"

"Nobody's trying to have it all done their way. We're conversing about what we think should be done."

"People are willing to do the mundane tasks like typing and, in our lab of course, it's always filling the pipette tip rack. Here, people are perfectly willing to do what needs to be done; people are positive."

"Nobody is saying what's in this for me and I'll only give to it what I can get out of it in terms of what I can put on my CV. None of that is here."

"Why can't my day-to-day science be like this? This is really nice."

The slide show provided the members of WIS with the context to speak out and describe the details of women's oppression within their community, their differing values, and their efforts for change. However, stepping outside of the norm--speaking out about women's beliefs and their experiences within the profession--came not without fear of reprisal. For example, one WIS member commented, "If a graduate student did this in my department, she would be crucified." During the presentation, a faculty member from the department commented, "Don't think that it's going unnoticed, just because there aren't crowds of people in the room. It is noticed." As indicated by the statement from the observer, the slides depicting women's experiences in the community, and the anxiety felt by WIS participants, these women's voices and statements came not by invitation. In contrast, the event illuminated how some women experience great conflict with the valued beliefs, capital, and practices of the science community in general[5] and how power and politics surround women in science as they speak out within their daily educational and work communities.

Summary

What must be considered to be gender-sensitive and facilitate women's and girls' legitimate participation in the science community? As the experiences and obstacles encountered by the women science educators in this study indicate, legitimate participation includes much more than the acquisition of knowledge, skills, and other kinds of capital valued by science

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[5]The capital valued by the study groups and their intersection with the science community is discussed at length in Davis, K. S. (1996). Science support groups for women and girls: Capturing the capital, challenging the boundaries, and defining the limits of the science community. Unpublished Doctoral Dissertation. Boulder, CO: University of Colorado.

and gaining access to the science community. In order to legitimately participate in this community of practice, it appears that a participatory approach is needed (Howe, 1993) within a multitude of structures, groups, individuals, and organizations (i.e., national funding bodies, state and local governments, local funding agencies, universities and schools, and private organizations and groups) such that women and girls 1) have contexts where they can meet in collective groups and reflect on their needs and experiences as they relate to their community participation, 2) are able to voice what their experiences are within the community, what structures, policies, and practices do or do not support their participation, what beliefs and practices conflict with their needs and values, and what should be changed, and 3) have decision-making and veto power within the community.

Women and girls must be provided with contexts to meet together, speak, and make decisions within multiple contexts such as local science programs like Explorers, the everyday school and work environment, and national decision-making structures. Through collectives, women reflect, define themselves, pursue self-expression and development, nurture and care for themselves, and make decisions and construct ways to put decisions into practice. Empowerment comes as women and girls make choices based on their own perceptions and judgments, draft the blueprints and strategies for their learning and professional development (Nicholson & Fredericks, 1991), create and implement goals, policies, programs, activities, and career experiences, and reflect on the effectiveness of their choices and what goals, policies, and practices should be maintained, modified, or discontinued.

In addition, women and girls need to claim both voice and power and challenge hegemonic social structures. For example, the WIS group supports women's efforts to speak out, share their experiences, and make changes in

their everyday environment. However, the science community and other powerful groups must take responsibility for hearing the experiences, interests, and perspectives of women and girls and their collective groups such as Explorers and WIS.

Key to women's legitimate participation in science is their opportunity to interact equitably within the community. However, as discussed above, there continue to be numerous limitations, obstacles, and tensions that inhibit women's and girls' equitable participation, even as women science educators seek to construct gender-sensitive environments for women and girls. Kymlicka states: "[I]t only makes sense to invite people to participate in politics (or for people to accept that invitation) if they are treated as equals...." (in Howe, 1993, p. 333). This statement makes sense for the science community as well.

Therefore, it seems necessary that educators and researchers carefully examine the ways in which the science community supports legitimate participation for all individuals through inclusive and participatory structures and practices. Individuals, groups, institutions, and organizations need to 1) provide women and girls with opportunities to meet in collective groups and share facets of their lives that are important to their educations and careers; 2) establish safe settings where women and girls can express how various experiences and practices in their science settings affect them; and 3) empower women and girls to make decisions about what they will experience as part of their educational and/or science programs, coursework, and careers. These steps are critical to women's and girls' acquisition of capital and credibility within the community, their legitimate participation in its practices, and the development of equity within science and science education.

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KINDS OF SKILLS USED IN EXPLORERS

| KINDS OF SKILLS | 3-10 N/S | 3-17 N/S | 3-31 N/S | 4-7 N/S | 4-14 N/S | 4-21 N/S | 4-22 S | 4-23 N/S | 4-29 S | 5-5 S | 5-12 N | 5-19 N | 5-20 N | 5-26 N | 6-2 N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Asking Questions | X/X | X/X | X/X | X/X | X/X | X/X | X | X/X | X | X | X | X | X | X | X |
| Communicating | X/X | X/X | X/X | X/X | X/X | X/X | X | X/X | X | X | X | X | X | X | X |
| Collecting | | | | | | | | | | | | | | | X |
| Comparing/ Contrasting | | /X | X/X | /X | X/X | | X | /X | | | | | | | X |
| Correlating | | X | X/X | | | | | | | | | | | | |
| Counting | | | | | X/X | | X | X/X | | | | X | | X | |
| Critical Thinking | | X/X | | /X | X/X | | X | /X | X | | | | | | X |
| Describing | X/ | X/X | X/X | | X/X | X/ | X | X/X | X | X | X | X | | X | X |
| Estimating | | X/ | | | | | | | | | | X | | | |
| Experimenting | X/X | X/X | | /X | X/X | | X | /X | X | | | | X | | |
| Explaining | X/ | X/ | X/X | X/X | X/X | X/X | X | X/X | X | X | X | X | | | X |
| Exploring | X/X | X/X | | /X | X/X | X/X | X | X/X | X | X | X | X | X | | X |
| Finding Patterns | | | X/X | /X | | | | | X | | | | | | |
| Graphing | | | X/X | | X/ | | | | | | | | | | |
| Heating/ Cooling | | | | | | | X | | | | | | | | |
| Illustrating | | | X/X | | | | | X/ | | | | X | | | |
| Making Something | X/X | X/X | | X/X | | X/X | X | X/X | X | | | | X | X | |
| Making a Chart | | | X/ | | | | | | | | | | | | |
| Making Decisions | /X | X/X | | /X | | X/X | X | X/X | X | X | X | X | | | X |
| Mapping | | | | | | | | | | | | X | | X | |
| Measuring | X/X | X/X | X/X | /X | | X/X | X | | | | | X | | X | |
| Mixing | X/X | X/X | | /X | | X/X | | | | | | | | | |
| Observing | X/X | X/X | X/X | X/X | X/X | | X | X/X | X | X | X | X | X | X | X |
| Organizing | X/X | X/X | X/X | | X/X | | | | | | | | | X | |
| Predicting | | X/ | X/ | | | | X | | | | | X | | | |
| Problem Solving | X/X | /X | | /X | | X/X | X | X/X | X | X | X | | | | |
| Taking Things Apart | | | | | | | | | | X | X | | | | |
| Using Tools | X/X | X/X | X/X | | X/X | | | X/X | | X | X | X | X | | |

Note. 3-10 = observation date; N = North Side Center; S = South Side Center; X = skill used in Explorers.



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INCOMING FUNDS
FOOTHILLS CITY YOUTH CLUB
1990-1995

| Funding Year | GYC 1990 | BYC 1990 | GYC & BYC 1990 | FCYC 1991 | FCYC 1992 | FCYC 1993 | FCYC 1994 | FCYC 1995 |
|---|---|---|---|---|---|---|---|---|
| City Funding | $21,000 | $16,000 | $37,000 | $34,000 | $34,000 | * $34,500 + $12,000 | *$34,000 +$10,000 | $34,000 |
| County Funding | $ 3,500 | $ 3,500 | $ 7,000 | $ 7,500 | $ 7,500 | $7,000 | $ 7,000 | |
| Total Local Gov't Funding | $24,500 | $19,500 | $44,000 | $41,500 | $41,500 | $41,500+ $12,000 | $41,000 + $10,000 | |
| United Way | $33,059 | $35,000 | $68,059 | $69,000 | $66,700 | $62,000 | $48,700 | $48,700 |
| Total Community Funding | $67,559 | $54,500 | $122,059 | $110,500 | $108,200 | $103,500 + $12,000 | $89,700 + $10,000 | |
| Contributions | $30,000 | $ 3,299 | $33,299 | $43,700 | $60,600 | $50,560 | $74,700 | |
| Dues | $ 8,046 | $ 697 | $ 8,743 | $10,396 | $12,763 | $18,000 | $16,500 | |
| Special Events | $ 4,400 | $3,100 | $ 7,500 | $12,700 | $10,252 | $16,000 | $16,800 | |
| Federal Grants (HUD) | | | | | $39,239 | $39,774 | | $270,000 (2 year) |
| Total Incoming Funds | $110,005 | $61,096 | $171,101 | $177,296 | $231,054 | $239,834 | $207,700 | |
| Number of Members | 336 | 245 | 581 | 620 | 734 | 872 | 1022 | |

*Indicates years where FCYC went back to the Foothills City Council and requested additional funding from federal funds. Additional amounts funded are noted separately.